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OPTIMIZATION OF PRODUCTION PLANNING AND CONTROL USING MICROSOFT EXCEL SHEET SOFTWARE

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ABSTRACT

Production Planning and Control (PPC) is essential for efficient and economical production. A PPC system plans for the orderly and systematic change of production capacity to meet peaks and valleys of the expected customer demand. Organizations willing to succeed in global competition have to integrate their internal and external processes. This specially includes planning and production control (PPC) processes. Optimized allocation of the production resources and quick response to demand change results in lower cost and improvement of production performance. Designing an efficient PPC system by implementing MS Excel PPC software is of the same importance. In the current work, firstly the latest production planning framework has been reviewed and modified. This framework has been customized to meet requirements and constraints of an industry by using developed PPC software. MS EXCEL spreadsheet has been used for production planning. As MS Office Excel is a widespread and used software system it has the advantage to be well known, thus making sense to use is as a tool for production planning. The application of mathematical model and logic has been considered for production system in an engineering industry.

KEYWORDS: KALTAN BLACK Machine, AMADA Machine, Cutting tool, Coolant, Energy.

INTRODUCTION:

For a manufacturing organization to be successful, it needs an effective production planning and control system. It must provide information to support the management of materials, both in and out of materials of the company to enable the company's assets to be utilized effectively and to coordinate the operation plan with both supplier and customers. The production plan should meet market requirements for fulfilling basic business profitability and market goals. It should provide the overall desired framework to develop the master production schedule and to evaluate capacity and resource requirements. Production planning determines expected inventory levels as well as the workforce and other resources necessary to implement the production plans. Production planning is done using an aggregate view of the production facility, the demand for products and even of time (using monthly time periods).

According to Corke D.K. [5] "This topic used to be called shop floor control, but now a days it is fully realized that much of the control is not situated on the shop floor but in the planning office, it is called production activity control".

K.Pandya [15] researched "investigations of the implementation of a reconfigurable Production Planning and Control (PP&C) system at the Cell Level. The implementation enables the Cell Supervisor to make decisions regarding the planning and control of the operations within the cell. The decision aid is in the form of a table of options from which run the cell efficiently. He proposed some rules that the CS may utilize to assist in making decisions or the rules, when emulated may replaces CS altogether".

Luis M.M. Custbdio et al [6] "proposed short-range planning and scheduling problems are addressed using a neoclassical approach supported by fuzzy theory. The proposed methodology uses a hierarchical structure similar to the one introduced in which includes three decision levels (higher, middle, lower) each responsible for a different production problem with a different time scale. The methodology approaches the tasks associated with each level using a heuristic formulation and solves the short range planning and scheduling problems with a no stationary policy. The higher decision level determines safety stock levels used to compensate for future resource failures. At the middle level, loading rates are computed. This is accomplish through a fuzzy controller that tends to minimize the error between the cumulative production and cumulative demand while keeping the work in process below acceptable values .Finally, the lower level controls the row of parts among the resources using a modified version of the Yager's fuzzy decision method. This method has the ability to use several criteria to generate a decision. Simulation results reveal that the proposed system exhibits good performance, in terms of a high production percentage and a low WIP, under resource failures and demand variations".

Kah- Fei Ho and Keith Ridgwg [17] described "the analysis and design of production planning and control system using the analysis of decision centers based on the GRAI method. They described a case study carried out prior to the introduction of cellular manufacture in an electric motor manufacturing company".

Goodwin, Cardillo J. and Bergmann E. [8] "The individual system modules are directly involved in this process plus certain supporting modules that are essential to the process. It shows the elements that make up the production control system".

Li Li et al [22] "Global competition and rapidly changing customer requirements are forcing major changes in the production styles and configurations of manufacturing organizations. Virtual enterprise is an advanced management and organizations schema for enterprise to survive, develop and enlarge competition priority in unpredictable, constant and fast variable competition environment. Whereas current production planning and control system can't meet the requirements of enterprises under virtual enterprises environment such as autonomy, disturbed, dynamic, heterogeneity, interoperability, corporation etc. a multi agent based distributed production planning and control system is pro[posed which is constructed by adding several intelligent agents on legacy production planning and control system to meet above all requirements. The aim of the system is to enhance the performance of enterprises under virtual enterprises to gain shorter dead line, rapid response to customers requirements, higher accuracy of delivery, less storage, higher resources utility, less transportation costs etc".

Heidi M.E. Korhonen et al [11] "Production planning and control in printed wiring board(PWD) manufacturing is becoming more difficult as PWD's technology is developing and the production routings become more complex. Simultaneously, the strategic importance of delivery accuracy, short delivery times and production flexibility is increasing with the highly fluctuating demand and short product life cycles of end products. New principles, that minimize throughput time while guaranteeing excellent customer service and adequate capacity utilization, are needed for production planning and control. Simulation is needed in order to develop the new principles and test their superiority. This paper presents an ongoing simulation project that aims at developing the production planning and control of a PWD manufacturer. In the project, a discrete event simulation model is built of a pilot case factory. The model is used for comparing the effect of scheduling, queuing rules, buffer policies and lot sizes on customer service and cost efficiency".

T.E. Volmann [21] "Production planning is commonly defined as the process of devising a production plan for groups of products over a month or quarter based on management targets for production, sales and inventory levels. It determines a tentative plan showing how much production will occur in the next several time periods".

Peter Bikfalvi et al [3] "Capability to adapt to the changing requirements of customers presents an increasing importance in the field of industrial production. Increasing demands of quality and reliability can only be met with a high level of readiness for delivery. The up- to- date ERP system include such Production Planning and Control (PPC) components that are based on theoretically well established state equations, production models, data based transactions and functional supplies. Three macro parameters : readiness for delivery, stock level and utilization of the available production resources can form such as abstract model – the "production triangle" on the basis of which a model meeting both the necessary and at the same time, the satisfactory conditions to realize a good approximation of optimum production planning and control can be created".

Matthias Schmidt et al [19] "Logistically controlling assembly areas is based on processing information. The availability of the required information is thus a decisive factor. They introduce an approach for controlling areas. The method is based on processing information from so called Getelligent parts. Gentelligent parts can function as storage mediums and as such are able to record, save, process and communicate information. Due to these properties, Gentelligent parts can function as a decentralized Enterprise Information System (EIS). As a result, extensive potential for improving logistic and technical processes arises along the product evolutionary process and during the usage phase".

Gunther Reinhart et al [16] "In an increasingly turbulent environment, convincing methods of production planning and control are required. Discrete event simulation has proven to be a suitable tool to fulfill this demand. However, as flows of materials are often influenced by ad-hoc decisions of workers, the quality of simulation models depends on the conformance of real-world decision strategies to the ones simulated. They proposed a method for identifying dynamic workflows caused by decisions of human workers using methods of pattern recognition. For this purpose, underlying data from production data acquisition (PDA) shall be analyzed to identify patterns and to recognize human strategies and provide them for an automated generation of simulation models.

Amir Hasanzadeh et al [9] "Organizations willing to succeed in global competition have to integrate their internal and external processes. This specially includes planning and production control (PPC) processes. Optimized allocation of the production resources and quick response to demand change results in lower cost and improvement of production performance. Practitioners and researchers have been trying to achieve these goals using production planning techniques. Although the results are significant, it seems necessary to integrate production operations in order to improve the production performance. Designing an effective PPC system and integrating it with process planning in a cellular environment is of the same importance".

L. Monch and J. Zimmermann [13] "Web services have been received an increasing importance over the last years, especially in connection with service oriented architectures (SOA) for the automation of business processes. Some authors anticipate that traditional ERP systems will lose their importance in the near future. We report on the development of the software prototypes that allow the experimental investigation of these expectations at the laboratory level. We find that production planning and control (PPC) functionally can be offered by web services, but a systematic identification of appropriate services that encapsulate PPC functionally is not straight forward and requires more research. Data management issues and transaction processing, that are an important part of integrated applications, have to be re-invented in service-based application system".

MATERIALS AND METHODS:

The main problem targeted in this work was to develop an efficient PPC software using Microsoft Excel sheet that would be helpful to management in controlling the operations during production, maintenance and decision making of an industry. The cutting section is choosing among hydraulic shop and transmission shop for the study work. The current work can be divided into three parts:

1. Study and reviewing the current PPC system
   - It includes noting down or monitoring the current production system
   - Recording daily processes and requirements
   - Control actions taken
2. Developing an effective PPC software

   After reviewing the current production system, effective PPC software will be developed that will eliminate the problems with the current PPC system.
3. The results obtained are analyzed and compared and finally recommendations are given to increase the productivity in the industry.

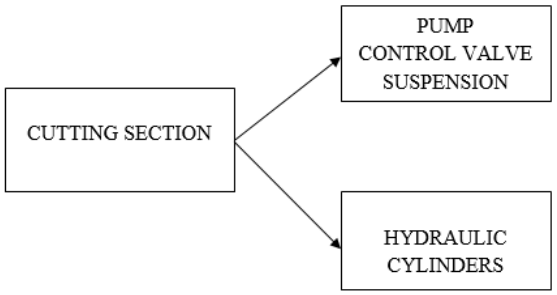
Existing Production Planning System:

I have selected hydraulic shop among hydraulic shop and transmission shop for the study work. The details of the layout, products and existing production planning system are described below:

Layout:

In hydraulic shop there are three sections under the control of three respective Sr. Managers. The layout is shown in figure. The three sections are:

1. Pump and Control valves
2. Suspension
3. Hydraulic cylinders



Layout of Hydraulic Section

Each item has a lot of varieties, which is used under different projects such as Dozers, Dumpers and Excavators. Each of these is coming in different models depending upon their capacity (Bd50, Bd65, Bd155, Bd355, Bh100, Bh85, Bh50, Bh40, Be220, BE650 and BE1600) and each variety is using more than two types of cylinders, pumps, control valves and different varieties are using different pumps, control valves, suspensions and cylinders depending upon their capacity. In the cutting section around 140 items are coming for cutting to fulfill the requirements of many projects. There are two machines (Kaltan and Amada) in the cutting section. As noted earlier there is no systematic planning in the cutting section which leads to following problems:

- There is no prioritization/scheduling of the jobs in the shops
- There is no machine loading and capacity planning
- Very high work in progress (WIP) is found in this section
- There is no planning and scheduling progress since tracking is difficult and in most of situation the number of units of item is not known
- Employees are exploiting the situation

Proposed Production Planning System:

The idea was to develop a system which works automatically with the input of demand and cutting data in cutting section. The primary requirement is that the system should be simple to apply and cater to the dynamic environment. For this MS Excel is used. MS EXCEL spreadsheet has been used for production planning. Microsoft Excel is available as a part of the popular MS Office package. It has an add-in module for solving problems called – Solver that can be used for tasks solving. As MS Office Excel is a widespread and used software system it has the advantage to be well known, thus making sense to use is as a tool for production planning.

RESULTS:

After the implementation of Microsoft Excel Sheet PPC software in Production Planning and Control, the results obtained are shown in table:

MACHINE NAME	LOADING (JOB CARD HOURS)
KALTAN BLACK (K)	323
AMADA (A)	532
OUTSOURCING (N)	555
TOTAL	1410

Load taken by different Machines in a month before MES

MACHINE NAME	LOADING (JOB CARD HOURS)
KALTAN BLACK (K)	323
AMADA (A)	532
OUTSOURCING (N)	535
TOTAL	1390

Load taken by different Machines in a month after MES

	BEFORE MES	AFTER MES
MACHINE NAME	LOADING (JOB CARD HOURS)	LOADING (JOB CARD HOURS)
KALTAN BLACK (K)	323	323
AMADA (A)	532	532
OUTSOURCING (N)	555	535
TOTAL	1410	1390

Comparison of load taken before and after MES

The available hours for a machine in one month are 20*24 = 480 hours. It is show-

ing which machine has more loads as shown above. So we can redistribute the load also. The load which we should give outside for sub contracting is shown by "N".

DISCUSSION:

The production planning sheet is showing the exact load which should be given outside to meet the demand. Further it is showing we should give those items outside having lesser dimensions, because it will reduce the transportation cost. Also, the employees are taking advantage of putting more than one item on AMADA machine and doing the work for very less time. It is because there is fix timing for each piece whether it is small or large and after doing three pieces in a single pass employees are not doing anything and taking advantage of the situation. So, we can give tubes, rods of lower outer diameter and only the tubes of large outer diameter should be cut in section. This will improve the production and reduce the idle machine hours.

CONCLUSION:

Basically the production planning and control system provide information to efficiently manage the flow of materials, effectively utilize people and equipment , coordinate internal activities with those of suppliers and communicate with customers about the market requirements. The PPC system does not make decisions or manage the operations-manager perform those activities. The system provides the support for them to do so wisely.

Current study was done in the cutting section of the plant. The cutting section was chosen for the study because there were lots of problems in the cutting section which affect the performance and immediate attention was required. Since there was no systematic planning and control in the cutting section further improvement with respect to e.g. quality etc. is difficult to implement.

The proposed methodology of production planning by means of the MS Excel spreadsheet is like small software doing all the work required in shop floor production. The proposed planning system uses the advantage of popularity of the MS Excel and can be easily applied, modified and extended to other section also. By following the production planning excel sheet, the cutting section will be under full control. After having full control over the section, the other aspects of manufacturing like six sigma, quality improvement etc. can be implemented.

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